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SPECIFICATION FOR TETRASODIUM PYROPHOSPHATE, ANHYDROUS, TECHNICAL

(First Revision)

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 5

July 1983

Indian Standard

SPECIFICATION FOR TETRASODIUM PYROPHOSPHATE, ANHYDROUS, TECHNICAL

(First Revision)

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Indian Standard

SPECIFICATION FOR TETRASODIUM PYROPHOSPHATE, ANHYDROUS, TECHNICAL

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 March 1983, after the draft finalized by the Inorganic Chemicals (Misc) Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was originally published in 1973. It has been revised incorporating two new requirements of tetrasodium pyrophosphate content and other polyphosphates as P_2O_5, taking into consideration the report on the investigation.

0.3 Tetrasodium pyrophosphate is a detergent builder. It is mixed with synthetic detergents to enhance their washing properties. It has found wide application as a deflocculant in the treatment of drilling muds for oil wells. There are also a large number of other applications in which the ability to deflocculate suspensions and to form soluble complexes exhibited by the pyrophosphate ion finds practical applications. Thus, certain types of dyes are solubilized by the addition of this material. It is also used in kier boiling, degumming silk, and other textile operations. Alkaline cleaners for heavy duty, such as metal cleaning often contain sodium pyrophosphate. Some application is found in electroplating. It is also used to stablize hydrogen peroxide baths for the removal of metal ions and is a reagent for de-inking newsprint.

0.4 Tetrasodium pyrophosphate is the most easily manufactured sodium polyphosphate. In making this material, anhydrous disodium orthophosphate is calcined at a temperature between 300 and 900°C. Conversion is rapid at elevated temperatures, and the rate of conversion does not affect the properties of the product.

0.5 Currently the material in this country is being produced from phosphoric acid made by the wet process from imported rock phosphate. Keeping this in view the requirements have been laid down.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for anhydrous tetrasodium pyrophosphate, technical for use as a detergent builder and as a deflocculant.

2. REQUIREMENTS

2.1 Description — The material shall consist essentially of tetrasodium pyrophosphate ($Na_4P_2O_7$). It shall be a white uniform free-flowing powder, free from visible impurities.

2.2 Sieve Analysis — When tested by the method prescribed in Appendix A, the material shall conform to the following size grading:

Sieve Size	*Percent by Mass*
Retained on 500-micron IS Sieve	Nil
Passing through 75 micron IS Sieve	50 *Min*

2.3 The material shall also comply with the requirements prescribed in Table 1 when tested according to the methods prescribed in Appendix B. Reference to relevant clauses of Appendix B is given in col 4 of the table.

3. PAKING AND MARKING

3.1 Packing — Unless agreed to otherwise between the purchaser and the supplier, the material shall be packed in polyethylene lined jute bags. The bags shall be sealed properly in order to prevent absorption of moisture and carbon dioxide.

3.2 Marking — Each bag shall be suitably marked with the following information:

a) Name and grade (anhydrous, technical) of the material;
b) Name of the manufacturer and/or his trade-mark, if any;

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*Rules for rounding off numerical values (*revised*).

c) Batch number to enable the lot of manufacture to be traced back from records;

d) Net mass; and

e) Year of manufacture.

TABLE 1 REQUIREMENTS FOR TETRASODIUM PYROPHOSPATE, ANHYDROUS, TECHNICAL

(*Clause* 2.3)

SL No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST (REF TO CL NO. IN APPENDIX B)
(1)	(2)	(3)	(4)
i)	Moisture, percent by mass, *Max*	1·0	B-2
ii)	Matter insoluble in water, percent by mass, *Max*	0·2	B-3
iii)	Phosphorus (as P_2O_5), percent by mass, *Min*	51·5	B-4
iv)	*p*H	10·3 ± 0·3	B-5
v)	Orthophosphate (as P_2O_5), percent by mass, *Max*	1·0	B-6
vi)	Tetrasodium pyrophosphate, percent by mass, *Min*	96·0	B-7
vii)	Other polyphosphate (as P_2O_5), percent by mass, *Max*	2·0	B-8
viii)	Iron (as Fe_2O_3), percent by mass, *Max*	0·025	B-9
ix)	Copper (as Cu), parts per million, *Max*	10	B-10

3.2.1 The bags may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors may be obtained from the Indian Standards Institution.

4. SAMPLING

4.1 The method of drawing representative samples of the material, the number of tests to be performed and the criteria for conformity of the material to the requirements of the specification shall be as prescribed in Appendix C.

APPENDIX A

(*Clause* 2.2)

SIEVE ANALYSIS

A-1. PROCEDURE

A-1.1 Clean and thoroughly dry the specified sieves. Nest the sieves in order with 500-micron IS Sieve on top. Weigh accurately 100 g of the well mixed material and transfer it into the top sieve. Shake the sieves simultaneously and occasionally tap the bottom sieve on a rubber cushion. When the portion of the material passing through the bottom sieve appears to be negligible, remove the top sieve and shake the sieve separately over a clean glazed paper to ensure that no more of the material passes through. Transfer from the paper any material that has passed through 500-micron IS Sieve to 150-micron IS Sieve using a camel hair brush. Repeat the procedure with 150-micron IS Sieve and 75-micron IS Sieve. Transfer the residue on the various sieves to convenient tared containers with the aid of a camel hair brush and weigh each separately.

A-1.2 Calculation — Calculate the mass on the basis of percent by mass of the material.

APPENDIX B

(*Clause* 2.3)

METHODS OF TEST FOR TETRASODIUM PYROPHOSPHATE, ANHYDROUS, TECHNICAL

B-1. QUALITY OF REAGENTS

B-1.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1977*) shall be used in tests.

NOTE — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the results of analysis.

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*Specification for water for general laboratory use (*second revision*).

B-2. DETERMINATION OF MOISTURE

B-2.1 Procedure — Weigh accurately about 5 g of the material in a clean wide-mouth glass weighing bottle, previously dried and weighed. Place the weighing bottle in an oven maintained at 110 ± 2°C for 3 hours. Cool in a desiccator and weigh with the lid on. Heat again for 30 minutes, cool and weigh. Repeat this process until the loss in mass between the successive weighings is less than 1 mg. Record the lowest mass obtained. Reserve the dried material for subsequent tests.

B-2.2 Calculation

$$\text{Moisture, percent by mass} = \frac{M_1 - M_2}{M_1 - M} \times 100$$

where

M_1 = mass in g of the weighing bottle with the sample before drying,

M_2 = mass in g of the weighing bottle with the sample after drying, and

M = mass in g of the empty weighing bottle.

B-3. DETERMINATION OF MATTER INSOLUBLE IN WATER

B-3.1 Procedure — Weigh accurately about 10 g of the material and dissolve it in 200 ml of water and boil for about 10 minutes. Filter the hot solution through previously dried and weighed sintered glass crucible G No. 3 or asbestos padded Gooch crucible. Wash the crucible with hot water till the filtrate is free from alkali. Place the crucible in an oven maintained at 110 ± 2°C for 2 hours. Cool the crucible in a desiccator and weigh. Repeat the process of heating, cooling and weighing till constant mass is obtained.

B-3.2 Calculation

$$\text{Matter insoluble in water, percent by mass} = \frac{M_2 - M_1}{M} \times 100$$

where

M_2 = mass in g of the crucible after filtration,

M_1 = mass in g of the crucible before filtration, and

M = mass in g of the material taken for the test.

B-4. DETERMINATION OF PHOSPHORUS

B-4.0 Outline of the Method — Total phosphorus is determined volumetrically by freshly hydrolyzing the material with dilute hydrochloric acid and then titrating with sodium hydroxide solution.

B-4.1 Apparatus

B-4.1.1 *Beaker* — 250-ml capacity, marked at the 100-ml level.

B-4.1.2 *pH Meter*

B-4.2 Reagents

B-4.2.1 *Dilute Hydrochloric Acid* — 5 N, and 0·5 N.

B-4.2.2 *Buffer Solution* — *p*H 10.

B-4.2.3 *Mixed Indicator Solution* — Mix equal volumes of bromocresol green (0·1 percent in water or 20 percent alcohol), phenolphthalein (0·5 percent in 60 percent alcohol) and absolute alcohol.

B-4.2.4 *Sodium Hydroxide Solution* — approximately 5 N and 0·1 N, freshly standardized.

B-4.3 Procedure — Weigh accurately about 3·5 g of the material into a beaker. Dissolve in water, transfer to a 500-ml volumetric flask, dilute to the mark and shake to mix. Pipette out 75 ml into a 250-ml beaker marked at the 100-ml level. Add 15 ml of dilute hydrochloric acid and dilute to 100 ml. Introduce a glass rod, cover with a watch glass and boil gently for 30 minutes. Add 0·5 ml of the mixed indicator, and neutralize the solution with 5 N sodium hydroxide solution to a blue-green colour. Add 0·5 N dilute hydrochloric acid until the indicator changes to yellow (about 0·5 ml is usually needed).

B-4.3.1 Dilute to 100 ml if necessary and boil for 15 minutes to expel carbon dioxide. Cool to room temperature. Wash and remove the watch glass and wash glass rod and walls of the beaker. Dilute to 100 ml. Place the beaker on the *p*H-meter assembly. With thorough stirring (preferably mechanical) add 0·1 N standard sodium hydroxide solution until the *p*H reaches 4·1. Alternatively, add the alkali in portions of about 0·2 ml, reading the burette after each addition, and interpolate to find the burette reading corresponding to *p*H 4·1.

B-4.3.2 Titrate to *p*H 8·8 with standard 0·1 N sodium hydroxide solution interpolating as above, if desired. The final volume shall be about 150-ml; hence, excessive rinsing of the burette tip, electrodes, etc, should be avoided.

B-4.4 Calculation

$$\text{Total phosphorus (as } P_2O_5 \text{)} = \frac{T \times f}{10\,000} \times 70{\cdot}98 \times \frac{500}{75} \times \frac{100}{M}$$

where

T = difference in volume of sodium hydroxide solution required in **B-4.3.1** and **B-4.3.2**.

f = factor of 0·1 N sodium hydroxide solution (*see* **B-4.5**), and

M = mass in g of the material taken for the test.

B-4.5 Standardization of 0.1 N Sodium Hydroxide Solution — Analyze a sample of pure anhydrous sodium pyrophosphate, by proceeding exactly as in **B-4.3** except for weighing accurately 3·8 g of the sample instead of 3·5 g.

$$\text{Total phosphorus (as } P_2O_5 \text{)} = \frac{T \times f \times 4{\cdot}732}{M} = 53{\cdot}38$$

$$f = \frac{53{\cdot}38 \times M}{4{\cdot}732 \times T}$$

where

T and f = same as in **B-4.4**, and

M = mass in g of pure sodium pyrophosphate taken.

NOTE — If pure anhydrous sodium pyrophosphate is not available, pure potassium dihydrogen orthophosphate crystals may be used for standardization of 0·1 N sodium hydroxide solution, then ± would be $\frac{52{\cdot}17 \times M}{4{\cdot}732 \times T}$.

B-5. DETERMINATION OF *p*H

B-5.1 Apparatus

B-5.1.1 *pH Meter* — A suitable *p*H meter fitted with glass and calomel electrodes.

B-5.2 Procedure — Weigh 1·0 g of the material into a 150-ml beaker, add 100 ml of freshly boiled and cooled water and stir to dissolve. Measure the *p*H of the solution after 10 minutes with the help of *p*H meter.

B-6. DETERMINATION OF ORTHOPHOSPHATE CONTENT

B-6.0 Outline of the Method — Unconverted orthophosphate content of the material is determined colorimetrically.

B-6.1 Apparatus

B-6.1.1 *Photoelectric Absorptiometer*

B-6.2 Reagents

B-6.2.1 *Standard Phosphate Solution* — Dry potassium dihydrogen phosphate crystals at 105 to 110°C for 1 hour. Weigh 0·963 8 g of dry salt and dissolve in 500-ml measuring flask and raise the volume up to the mark. One millilitre of this solution is equivalent to 1·0 mg of P_2O_5.

B-6.2.2 *Ammonium Metavanadate*

B-6.2.2.1 Dissolve 1·0 g of ammonium metavanadate in hot water in a beaker. Allow it to cool (solution A).

B-6.2.2.2 Dissolve 20 g of ammonium molybdate in hot water in a beaker. Allow it to cool (solution B).

B-6.2.2.3 Transfer solution A to a 1-litre measuring flask, add 225 ml of perchloric acid with constant shaking. Then add solution B to the flask with constant shaking and raise the volume up to the mark.

B-6.3 Procedure

B-6.3.1 Weigh about 1 g of the sample and dissolve it in sufficient amount of water. Transfer it to 100-ml measuring flask and make up the volume (solution C). Take between 2 to 5 ml of solution C in a 100-ml measuring flask and add to it about 35 ml of water and 25 ml of ammonium metavanadate reagent and make up the volume up to the mark. Measure the absorbance at 420 nm.

B-6.3.2 *Preparation of Calibration Curve* — Take 0, 0·5, 1·0, 1·5, 2·0 and 2·5 ml of standard phosphate solution in series of 100-ml measuring flasks and add to it about 25 ml of water and 25 ml of ammonium metavanadate reagent, make up to the mark and shake. Measure the aborbance of each solution at 420 nm. Plot absorbance against concentration to get a standard graph. Find out the P_2O_5 concentration (in mg) of unknown sample from the standard graph by comparing the absorbance.

B-6.4 Calculation

$$\text{Orthophosphate content (as } P_2O_5 \text{), percent by mass} = \frac{M \times 100}{M_1}$$

where

M = orthophosphate content in g in 100 ml of the sample solution, and

M_1 = mass in g of the material taken for the test.

B-7. DETERMINATION OF TETRASODIUM PYROPHOSPHATE (TSPP)

B-7.1 Apparatus

B-7.1.1 *pH Meter* — A suitable *p*H meter fitted with glass and calomel electrodes.

B-7.1.2 *Volumetric Flasks* — 500 ml capacity.

B-7.2 Reagents

B-7.2.1 *Dilute Hydrochloric Acid* — approximately 5 N.

B-7.2.2 *Zinc Sulphate Solution* — approximately 0·2 M.

B-7.2.3 *Dilute Sodium Hydroxide* — 1 N.

B-7.2.4 *Dilute Hydrochloric Acid* — 1 N.

B-7.3 Procedure — Weigh accurately about 2·5 g of the material into a beaker. Dissolve in water, transfer to a 500-ml volumetric flask. Transfer an aliquot containing 0·2 to 0·3 g of the material in a 500-ml beaker, dilute to 100 ml and adjust the *p*H to 4·0-4·5 with dilute hydrochloric acid using a *p*H meter after immersing the beaker in a water bath at 19°C.

Add with continuous stirring, 70 ml of an approximately 0·2 M solution of zinc sulphate and continue to agitate for 5 minutes.

Readjust the *p*H to 4·0-4·5 with dilute sodium hydroxide solution, remove the beaker from the water bath and allow to stand for 15 minutes.

Filter off the precipitate through a Whatman No. 40 filter paper and wash with 150 ml of ice cold water. Dissolve the precipitate through the paper with about 5 ml of 1 N hydrochloric acid and preserve the paper.

Heat the resultant solution to 19°C as before and add 25 ml of 0·2 M solution of zinc sulphate. Again adjust the *p*H to 4·0-4·5.

Remove the beaker from the bath, allow to stand for 15 minutes and filter and mash as before.

Place both the papers into a tared porcelain crucible and ignite at 900-940°C after charging the filter paper at low temperature initially. Cool, and weigh as zinc — pyro-phosphate, $Zn_2P_2O_7$.

B-2.7 Calculation

$$\text{Tetrasodium pyrophosphate (as } Na_4P_2O_7 \text{), percent by mass} = \frac{M \times 0{\cdot}872 \times 100}{M_1}$$

where

M = mass in g of the residue, and

M_1 = mass in g of the material taken for the test.

B-7.5 Calculation

$$P_2O_5\text{, percent by mass due to TSPP} = \text{percent TSPP content } (\textbf{B-7.4}) \times 0{\cdot}537$$

B-8. DETERMINATION OF OTHER POLYPHOSPHATES AS P_2O_5

B-8.1 Calculation

Other polyphosphate (as P_2O_5), percent by mass

= Percent total P_2O_5 content (as determined in **B-4.**)

— [percent orthophosphate content (as determined in **B-6**)

+ percent P_2O_5 due to TSPP (as determined in **B-7.5**)].

B-9. DETERMINATION OF IRON

B-9.0 Outline of the Method — Iron is determined colorimetrically by measuring the transmittancy of reddish-violet colour produced by ferrous and ferric ion with thioglycollic acid at *p*H 10.

B-9.1 Apparatus

B-9.1.1 *Photoelectric Absorptiometer*

B-9.2 Reagents

B-9.2.1 *Dilute Hydrochloric Acid* — approximately 5 N.

B-9.2.2 *Sodium Citrate Solution 1 M* — 29·4 g per 100 ml, or alternatively ammonium citrate solution (2 M) 43·0 g per 100 ml may be used.

B-9.2.3 *Ammonium Hydroxide* — approximately 16 N.

B-9.2.4 *Thioglycollate Reagent* — Add 20 ml of ammonium hydroxide to 30 ml of water, and then add a mixture of 10 ml of thioglycollic acid and 40 ml of water.

B-9.2.5 *Standard Iron Solution* — Dissolve 0·491 1 g of ferrous ammonium sulphate [$FeSO_4(NH_4)_2SO_4{\cdot}6H_2O$] in water, and add 10 ml of dilute sulphuric acid (10 percent *v/v*). Dilute to exactly 100 ml in a volumetric flask. Take 25 ml of this solution into a 250-ml volumetric flask and dilute to the mark with water. One millilitre of this solution contains 0·1 mg of iron (as Fe_2O_3).

B-9.3 Procedure — Weigh accurately 1 g of the material into a 150-ml beaker. Add 30 ml of water and 5 ml of dilute hydrochloric acid. Introduce a glass rod, cover with a watch glass and boil gently for 15 to 20 minutes. Cool and transfer to a100-ml volumetric flask and dilute to about 70 ml. Place 5 ml of dilute hydrochloric acid and 65 ml of water in a second flask as blank.

B-9.3.1 To each flask, add 4 ml of sodium citrate solution (or 2 ml of ammonium citrate solution), 5 ml of thioglycollate reagent and 15 ml of ammonium hydroxide, swirling after each addition. Dilute to the mark and mix well.

B-9.3.2 Balance the absorptiometer at blank using green filter No. 4 and 4-cm cells. (Use 1-cm if the colour is too strong.) Find the reading with the sample solution. Read off milligram iron from the standard calibration graph (*see* **B-9.3.3**).

B-9.3.3 *Standard Calibration Graph* — Pipette known volumes of standard iron solution into each of 100-ml volumetric flasks containing 5 ml of dilute hydrochloric acid. Proceed as in **B-9.3.1**. Suitable aliquots are 0, 1·0, 1·5, 2·0, 2·5 and 3·0 ml. Take the readings. Plot graph with milligram iron as ordinates and absorptiometer readings as abscissae. Draw a line through the points and extend through the origin. Label the graph with particulars of filters and cells used.

B-9.4 Calculation

$$\text{Iron (as } Fe_2O_3 \text{), percent by mass} = \frac{M_1}{10 \times M}$$

where

M_1 = mass in mg of iron (Fe_2O_3) read off from the graph, and

M = mass in g of the material taken for the test.

B-10. DETERMINATION OF COPPER

B-10.1 Outline of the Method — Copper is determined colorimetrically by measuring the colour produced by the material when reacted with zinc dibenzyl dithiocarbamate. The value is read off from a standard calibration graph.

B-10.1 Apparatus

B-10.1.1 *Separating Funnels* — 100 ml capacity. Rinse the funnel with dilute hydrochloric acid and with water before use. Allow to drain, then dry the stems with pure absorbent cotton wool and place a small plug of cotton wool in each stem.

B-10.1.2 *Photoelectric Absorptiometer* — with 1-cm cells.

B-10.2 Reagents

B-10.2.1 *Dilute Hydrochloric Acid* — 5 N.

B-10.2.2 *Zinc Dibenzyl Dithiocarbamate Solution* — 0·04 percent in carbon tetrachloride.

B-10.2.3 *Standard Copper Solution* — Weigh 0·491 g of copper sulphate pentahydrate ($CuSO_4, 5H_2O$) in a weighing bottle. Wash into a 250-ml volumetric flask. Add 3 ml of 18 N sulphuric acid, dilute to about 100 ml and swirl until the salt has completely dissolved. Dilute to the mark and mix well. This is the stock solution, 1 ml of which contains 0·5 mg of copper (Cu). Take 3 ml of 18 N sulphuric acid and about 200 ml of water in a 1 000-ml volumetric flask. Carefully pipette 5 ml of the stock copper solution into the flask. Dilute to the mark and mix well. One millilitre of this solution contains 2·5 μ g of copper (Cu).

B-10.3 Procedure

B-10.3.1 Weigh accurately 2 g of the material into a 250-ml beaker. Take a smaller mass if the copper is expected to exceed 10 parts per million. Add 30 ml of dilute hydrochloric acid and boil gently for 15 minutes. Place 30 ml of dilute hydrochloric acid in a second beaker as blank and continue further with the same procedure as in the case of sample solution. Allow to cool, then add ammonium hydroxide until the solution is alkaline to litmus paper. Add dilute hydrochloric acid dropwise until the solution is acidic and then add 3 ml in excess.

B-10.3.2 Transfer to a separating funnel and, if necessary, dilute to 50 ml. Add 10 ml zinc dibenzyl dithiocarbamate solution and shake vigorously for at least 2 minutes. Allow the layers to separate, then unstopper the funnel, and run the lower layer through a plug of cotton wool into a 1-cm cell, using the first few drops to rinse out the cell. Adjust the photometer at zero to 440 nm (blue photocell, plain glass filter) then with a cell of zinc dibenzyl dithiocarbamate solution in the light path, measure the sample and the blank. Read off parts per million copper from the standard calibration graph (*see* **B-10.3.3**).

B-10.3.3 *Standard Calibration Graph* — Take 5 separating funnels. Wash thoroughly with hydrochloric acid and then with water. In each funnel place 3 ml of 5 N dilute hydrochloric acid. Using pipettes or a micro burette, measure respectively 0, 2, 5, 10 and 15 ml of standard copper solution. Dilute to 50 ml and proceed as in **B-10.3.2**. Subtract a constant from each observed colorimeter reading so that the blank solution with no added copper corresponds to a reading of 0. Convert volumes of standard copper solution to micrograms copper by multiplying by 2·5. Plot graph with micrograms as ordinates and adjusted colorimeter readings as abscissae. Draw a line through the points and through the origin. Label the graph with particulars of cells and filters.

B-10.4 Calculation

$$\text{Copper (Cu), parts per million} = \frac{M_1}{M}$$

where

M_1 = mass in μg of copper read off from the graph, and
M = mass in g of the material taken for the test.

APPENDIX C

(*Clause* 4.1)

SAMPLING OF TETRASODIUM PYROPHOSPHATE, ANHYDROUS, TECHNICAL

C-1. GENERAL REQUIREMENTS OF SAMPLING

C-1.0 In drawing, preparing, storing and handling the samples, the following precautions and directions shall be observed.

C-1.1 Samples shall not be taken at a place exposed to the adverse effects of weather.

C-1.2 The sampling instruments and sample containers shall be clean and dry.

C-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contaminations.

C-1.4 To draw a representative sample the contents of each container selected for sampling shall be mixed as thoroughly as possible.

C-1.5 The sample shall be placed in suitable clean, dry and air-tight glass or other suitable containers on which the material has no action.

C-1.6 The sample containers shall be of such a size that they are almost completely filled by the sample.

C-1.7 Each sample container shall be sealed air-tight after filling and marked with full details of sampling, the date of sampling, lot and batch numbers.

C-2. SCALE OF SAMPLING

C-2.1 Lot — All the containers in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared or known to consist of different batches of manufacture, the batches shall be marked separately and the groups of containers in each batch shall constitute separate lots.

C-2.1.1 Samples shall be tested from each lot for ascertaining conformity of the material to the requirements of the specification.

C-2.2 The number (*n*) of containers to be selected at random from the lot shall depend on the size of the lot and shall be in accordance with Table 2.

TABLE 2 NUMBER OF CONTAINERS TO BE SELECTED FOR SAMPLING

LOT SIZE N	NO. OF CONTAINERS TO BE SELECTED n
(1)	(2)
Up to 25	3
26 to 50	4
51 to 100	5
101 to 200	6
201 and above	8

C-2.3 These containers shall be chosen at random from the lot. For random selection procedures, guidance can be had from IS : 4905-1968*. In case this standard is not readily available, the following procedure shall be adopted.

C-2.3.1 Arrange all the containers in the lot in systematic manner and starting from any container, count them as 1, 2, 3, ..., etc, up to r, where r is the integral part of N/n (N and n being the lot size and the number of containers to be selected respectively). Every rth container thus counted shall be withdrawn to constitute the sample.

C-3. TEST SAMPLES AND REFEREE SAMPLES

C-3.1 From each of the containers selected according to **C-2.2**, draw with an appropriate sampling instrument a representative portion of the material, sufficient for carrying out the tests specified under **2**. These shall constitute the individual samples.

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*Methods for random sampling.

C-3.2 From each of the individual samples, a small but equal quantity of the material shall be taken and thoroughly mixed to constitute a composite sample.

C-3.3 The material in the individual and composite samples shall be divided into three equal parts and transferred to separate bottles, sealed and labelled with full identification particulars of the samples (*see* **C-1.7**). The material in each such bottles shall constitute a test sample. Separate these test samples representing individual and composite samples into three identical set of test samples.

C-4. NUMBER OF TESTS

C-4.1 Tests for the determination of phosphorus content, matter insoluble in water and orthophosphate shall be conducted on each of the individual samples.

C-4.2 Test for the remaining characteristics shall be conducted on the composite sample.

C-5. CRITERIA FOR CONFORMITY

C-5.1 Phosphorus Content, Matter Insoluble in Water (Orthophosphate, Tetrasodium Pyrophosphate and other Polyphosphates) — The individual test results for each of these characteristics shall satisfy the relevant requirements if the lot is to be declared as conforming to the specification.

C-5.2 For the remaining characteristics, all the test results shall satisfy the corresponding requirements given in col 3 of Table 1.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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